Demographic Change and New Zealand's Economic Growth

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NEW ZEALAND TREASURY

WORKING PAPER 03/04

JUNE 2003

THE TREASURY

Kaitohutohu Kaupapa Rawa

NZ TREASURY WORKING PAPER 03/04

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MONTH/YEAR

June 2003

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ACKNOWLEDGEMENTS

Thank you to Bob Buckle, Veronica Jacobsen, and Ian Pool for detailed suggestions. Thank you also to colleagues in the Policy Coordination Development Section, and participants at a Treasury seminar, for comments and questions.

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Abstract

New Zealand has, by OECD standards, high birth rates. This has provided New Zealand with a relatively young population and continuing labour force growth. Both these features are, on many accounts, good for economic growth. Yet most discussions of New Zealand's economic performance and its prospects for moving up the OECD income distribution have paid little attention to demography.

This paper defines "demography" narrowly as population size, growth, and age-structure, and examines the likely effects on New Zealand's growth rate in GDP per capita, relative to the rest of the OECD. The first part of the paper gives a broad overview of trends in population size and age structure in New Zealand and elsewhere in the OECD. The second part describes selected demographic trends in more detail and discusses their economic significance. The overall conclusion is future demographic trends are likely to provide New Zealand with a small advantage, relative to the rest of the OECD.

JEL CLASSIFICATION J1 – Demographic economics

KEYWORDS New Zealand; OECD; demography; economic growth

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1 Introduction

New Zealand has slipped down many OECD league tables since the 1950s, but not the table for fertility rates. In 2000, New Zealand's fertility rates placed it fifth in the OECD, some way behind Turkey and Mexico, but only marginally behind the United States and Iceland.[1] Higher fertility rates generally mean a younger population and continued labour force growth. Many commentators argue that a younger population and growing labour force is good for economic growth. New Zealand's relatively high birth rates may therefore give New Zealand a slight economic advantage over other OECD countries. This needs to be taken into account when assessing New Zealand's prospects for returning to the top half of the OECD. It also needs to be taken into account when assessing the relevance of imported policy prescriptions about maintaining growth rates in the face of an "old age crisis" (World Bank 1994; OECD 1998). Yet demographic trends have received little attention in recent debate on the New Zealand economy.

This paper surveys the likely effects of New Zealand's slightly unusual demographic profile on its prospects for growth in GDP per capita. "Demography" is defined narrowly to mean population size, growth, and age-structure. Some topics that are occasionally included under the heading of demography, such as education levels or population "quality", are deliberately excluded. The paper also abstracts away from many country-specific details. For instance, when looking at the effects of population ageing on labour force participation, the paper ignores cross-country differences in age-specific participation rates.

The decision to focus on the demographic basics was taken partly on pragmatic grounds—the paper needed to be restricted somehow—and partly in reaction to previous research. With some important exceptions, such as the work summarized in Bloom (2001), the international literature on the economics of population has placed relatively little emphasis on detailed exploration of underlying demographic trends. For instance, of the 30 background papers that the OECD commissioned for its 1998 report *Maintaining Prosperity in an Ageing Society*, none looked specifically at the demographic trends (OECD 1998: 138-9). Some demographers have been conducting detailed analyses of demographic trends with likely economic significance (Pool 2000; McDonald and Kippen

[1] This is based on estimates of the "total fertility rate" obtained from the OECD *Health Indicators* online database. The total fertility rate is the number of births the average woman would have over her lifetime if prevailing age-specific fertility rates were to be maintained indefinitely. The OECD estimates are as follows: Mexico, 2.62; Turkey, 2.50; United States, 1.99; Iceland 1.98; New Zealand, 1.97.

2001), but this has had limited impact on economics. The result is that the pool of stylised demographic facts drawn on by most economic analyses is very limited.

The first part of this paper gives a broad overview of trends in population size and age structure in the OECD, and at the underlying trends in fertility, mortality, and migration. It begins by looking at the OECD as a whole, and then moves on to comparisons between New Zealand and other countries and regions. The second part of the paper combines demography and a little economics. It describes selected demographic trends in more detail and discusses their potential economic significance, including their likely impact on New Zealand's ability to raise its GDP per capita closer to that of wealthier OECD countries. The emphasis of the paper is generally on relative, rather than absolute, GDP levels and growth rates. The paper does not consider the relationship between changing demography and savings, a large topic that has received detailed treatment elsewhere (Hurd 1997; Weil 1997).

The paper concludes that future trends in the proportional share of the working-age population and in the balance between young and old dependants will advantage New Zealand compared to Europe and Japan, but not compared to Australia and North America. The advantage is likely to be relatively small: it would be unrealistic to expect narrowly defined determinants such as population size and structure to have a large influence on a phenomenon as complicated as economic growth. But the predictability of demographic change means that incorporating demography into discussions of future economic prospects can nevertheless be valuable.

2 Overview of demographic trends

2.1 The sample and data

The paper compares only across countries in the OECD. Most policy discussion concerns New Zealand's position in the OECD income distribution rather than the world income distribution. The paper's approach of holding institutions, income levels, culture, and other determinants of long-run economic performance constant is also more sensible when comparison is limited to the OECD than it would be for a larger, more heterogeneous group.

The paper uses data for all 30 OECD countries. Results are shown for New Zealand, Australia, Japan, and the three groups defined as follows:

Group	Countries included
Europe	Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, United Kingdom
Recently developed countries (RDCs)	Korea, Mexico, Turkey
North America	Canada, United States

Australia is treated separately because the Australian and New Zealand labour markets are closely integrated, and because Australia is the principal country with which New Zealand compares itself. The three groups have been assembled on the basis of geography and economic similarity. Japan forms its own group, as it does not fit into any of the others. The groups would be slightly different if they had been assembled on the basis of demographic similarity. France, for instance, would be included with the United

States, and Canada would be included with the European countries, on the basis of current fertility rates (France, like the United States, has significantly higher fertility than Canada). The contrasts between the demographic prospects of different groups would be more marked if current demographic conditions, rather than geography or current economic conditions, had been used to assign countries to groups.

The paper uses "the OECD" as shorthand for "countries that are currently members of the OECD". This leads to a few anachronisms, such as references to the OECD population in 1950, although the OECD was not established until 1961. The justification is convenience.

The demographic estimates and projections are obtained from the United Nations Population Division's online database *World Population Prospects: The 2002 Revision*.[2] The UN estimates and projections are the only ones available that are sufficiently detailed, consistent, and comprehensive to enable the cross-country comparisons carried out in this paper.

2.2 Uncertainty about future demographic trends

The UN projections are not well suited, however, to properly representing uncertainty about future demographic trends. The UN represents uncertainty simply by calculating three different projection variants based on "high", "median" and "low" fertility assumptions, with the median assumption being the UN's preferred estimate. As demographers now emphasise, the traditional variant approach can give misleading results. The only internally consistent and readily interpretable way of representing uncertainty about future demographic trends is to construct fully stochastic population projections (Lutz, Vaupel, and Ahlburg 1998; Bryant 2003a).

Since stochastic population projections with the required level of detail are not available, this paper cannot represent uncertainty in a satisfactory way. The charts in this paper show only the UN's median variant. Warning are, however, attached to results that demographic principles suggest are particularly uncertain. The paper also avoids spuriously precise statements of the form "Country X's population will begin to decline in year 2037."

2.3 Trends in OECD averages

This section averages across the entire OECD, to establish the major trends. Cross-country differences are examined in the following section.

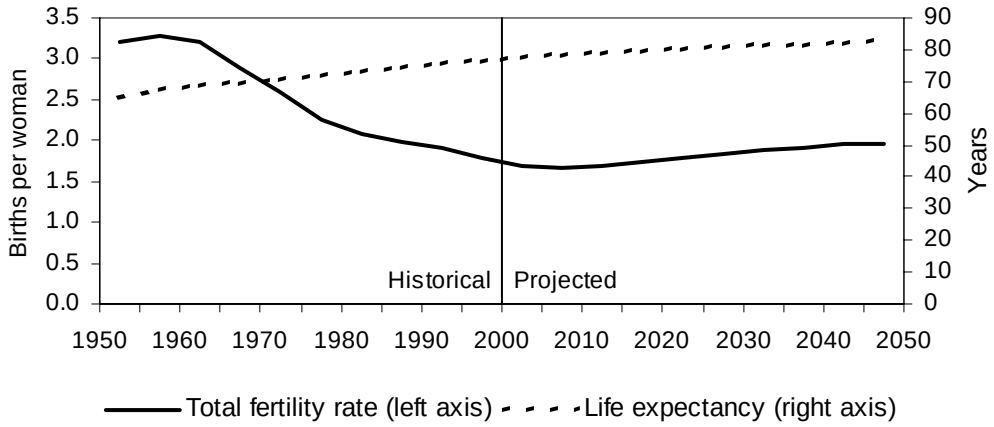
Movements in population size and age structure are driven by movements in fertility, mortality, and migration. Figure 1 shows fertility and mortality rates. Fertility is measured using the "total fertility rate". This is the sum of (single-year) age-specific fertility rates; it has an intuitive interpretation as the number of births the average woman would have over her life time if prevailing age-specific fertility rates were to prevail indefinitely. Average fertility has clearly been falling since the 1960s. Fertility rates during the 1950s and 1960s, the height of the baby boom, were in fact higher than they had been for several decades, except in the recently developed countries (RDCs) and Japan. Even in the RDCs, however, the post-war declines in infant and child mortality meant that "net" fertility

[2] http://esa.un.org/unpp/

was higher than previously. The UN median variant projection shown in Figure 1 assumes that average fertility will rise somewhat in coming decades.

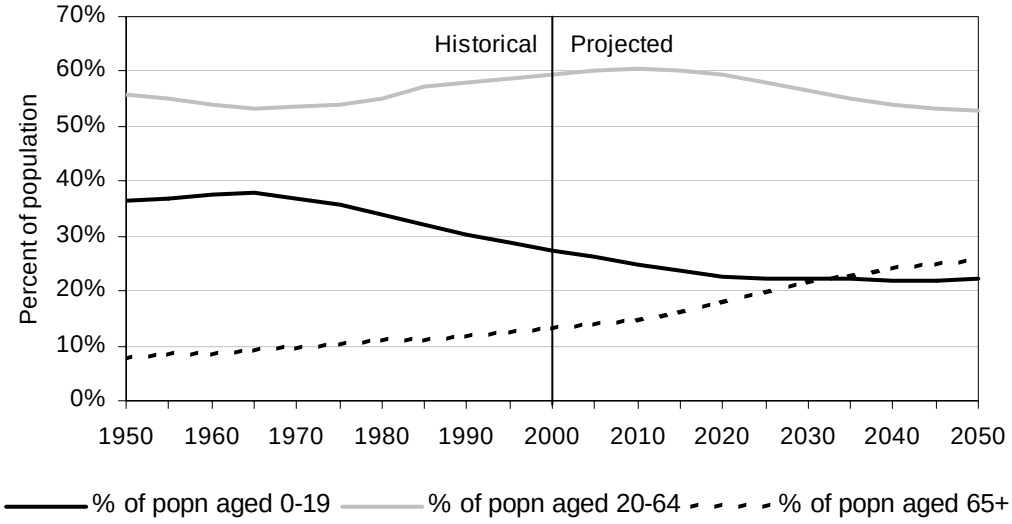
Mortality is measured in Figure 1 by life expectancy at birth. As is apparent in the figure, the UN assumes that gains in life expectancy will be smaller in future decades than they have been in past decades. There are as yet no signs of a slow-down, however, and demographers are increasingly arguing that the UN is underestimating future life expectancies (Vaupel 1997).

Figure 1 – Estimates and projections of fertility and mortality levels for the OECD



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Figure 2 – Estimates and projections for the age structure of the OECD



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Unfortunately, data on total migration into and out of the OECD as a whole are scarce. The UN's *Population Prospects* online database does show, however, that net migration into "developed regions" in 2000 was about 1.8 migrants per thousand population. Migration on this scale is sufficient to materially affect population growth rates, but not age structure.[3]

[3] This can be illustrated using Statistics New Zealand's projections for the New Zealand population in 2051. Projection Series 3 and 6 use identical fertility and migration assumptions, but in Series 3 net annual migration is 0, while in Series 6 it is 20,000. Higher migration levels raise population size in 2051 by 30%, but raise the proportion of the population in the age group 15-64 by only 3%

Past and projected population sizes and growth rates for the whole of the OECD are shown in the bottom row of Table 1. The OECD as a whole grew steadily over the period 1950-2000, but the UN predicts that in-migration and future improvements in mortality will only partly compensate for lower birth rates, so that population growth will slow markedly in the future.

Figure 2 shows trends in age structure. Note that the working-age population is defined here, and throughout the paper, as ages 20-64, and not 15-64, 15+, or 20+ as is often done. Most 15-19 year olds in OECD countries are now in education rather than work, so an increase in the size of this age group is more accurately represented as an increase in the "dependent" population than the "working age" population. An analogous argument applies to people aged 65 and over.

The age groups used here and in most other charts in this paper are very broad, to simplify comparisons. This means, however, that only the most pronounced structural changes are visible.

Table 1 – Estimates and projections of population size and growth rates

	Historical			Projected	
	Population in 1950 (millions)	Population in 2000 (millions)	Mean annual growth rate 1950-2000	Population in 2050 (millions)	Mean annual growth rate 2000-2050
Australia	8.2	19.1	1.7%	25.4	0.6%
Europe	350.8	452.7	0.5%	379.1	-0.3%
Japan	83.6	127.1	0.8%	98.7	-0.5%
New Zealand	**1.9**	**3.8**	**1.4%**	**4.2**	**0.3%**
RDCs	68.9	212.3	2.3%	289.9	0.6%
N America	171.6	314.0	1.2%	417.9	0.6%
OECD Total	685.0	1128.9	1.0%	1215.2	0.2%

Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

The proportional shares of the three age groups in Figure 2 show the imprint of the baby boom and subsequent baby bust.[4] The proportional share of the 0-19 age group increased, mainly at the expense of age group 20-64, during the baby boom decades of the 1950s and 1960s. From the 1970s, however, the proportional share of the age group 20-64 increased again as the baby boom cohorts began to turn 20. As long as the baby boom cohorts remain in the working ages, the proportional share of 20-64 age group will remain high. From about 2020, however, when the baby boom cohorts start to reach age 65, the proportional share of the 20-64 age group is projected to fall, and the share of the 65+ age group is projected to rise. The low fertility rates experienced since the 1980s have kept the proportional share of the 0-19 group small.

The population waves induced by the baby boom and bust have been occurring simultaneously with a rise in the proportional share of older people, resulting from continuing life expectancy gains. Given that the UN may have underestimated the potential for continued increases in life expectancy, the proportional share of the aged may well turn out to be higher than Figure 2 suggests.

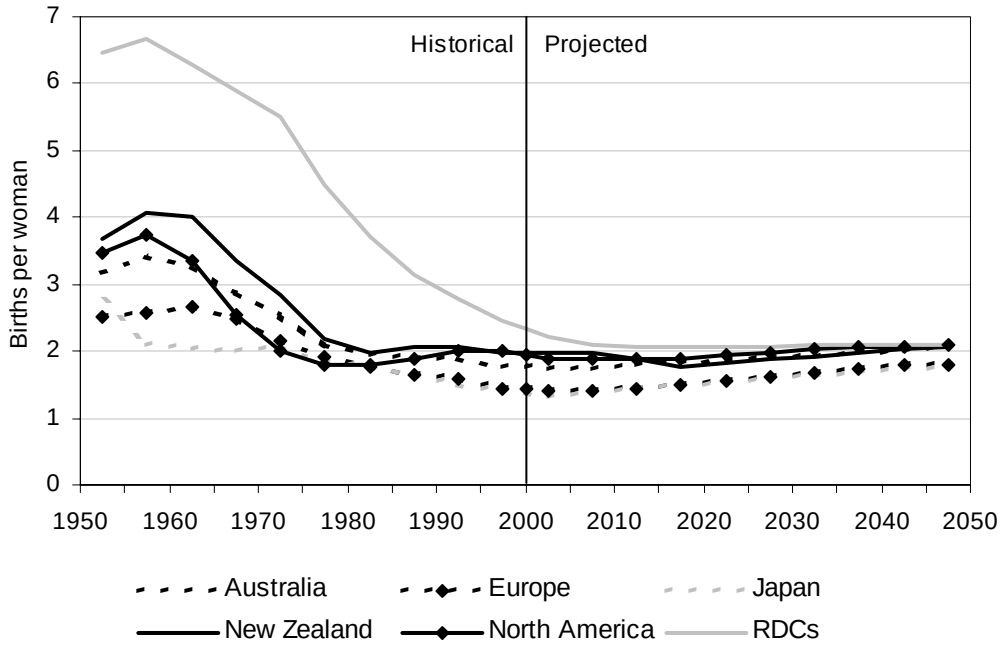
(calculated from Statistics New Zealand, National Population Projections, 2001(base)-2051, Tables 2 and 3, available online at www.stats.govt.nz.)

[4] A typology and framework for analysing age-structural changes is set out in Pool (2000, 2001).

2.4 Geographical differences

As Figure 3 shows, the recently developed countries (RDCs) have experienced the highest fertility levels in the OECD. New Zealand has, however, had the highest baby boom fertility rates of the non-RDCs shown, though in the decades since the baby boom New Zealand has had similar rates to North America, and only slightly higher rates than Australia. The UN's median projection implies substantial convergence over coming decades, except that New Zealand, Australia, the RDCs, and North America are assumed to maintain slightly higher fertility than Europe and Japan.

Figure 3 – Estimates and median variant projections of total fertility rates, OECD countries and regions



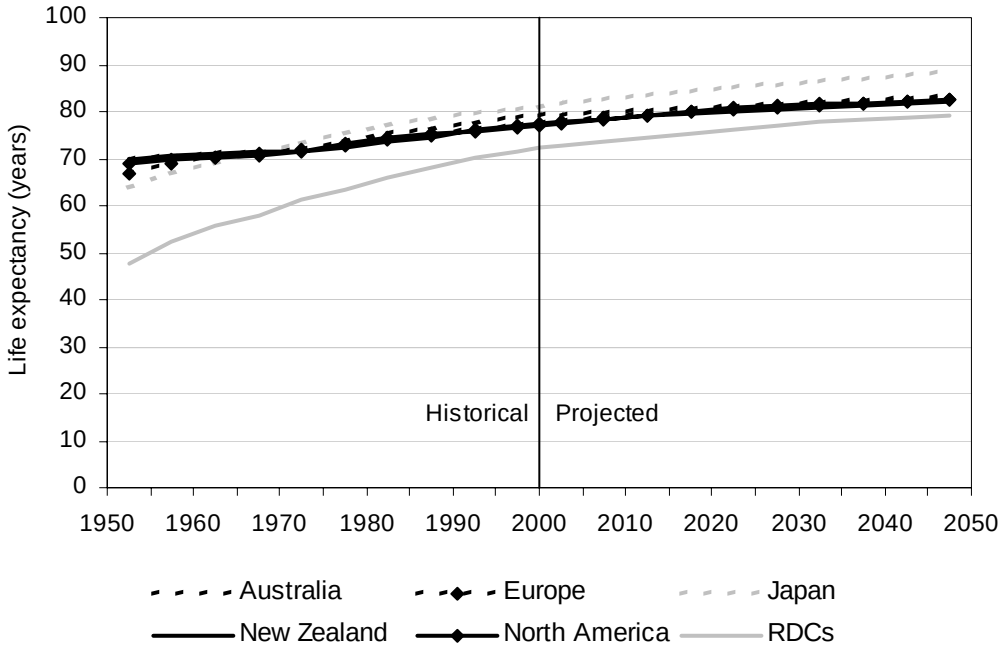
Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Figure 4 presents estimates and projections for life expectancy. With the exception of Japan and the RDCs, the expectancies are tightly bunched. One demographer even suggests that the group of the 21 biggest and most industrialized countries "is behaving increasingly as if it had a single mortality pattern" (White 2002: 74). The UN assumes that life expectancy will continue to grow faster in Japan that in other wealthy countries. Some demographers have, however, questioned this assumption (Wilmoth 1998; White 2002). The UN estimates that in recent years, New Zealand has had net inward migration levels of 1 to 2 per thousand. The corresponding figures are 3 to 5 per thousand in Australia and North America, 1 to 2 per thousand in Europe, 0 to 1 per thousand in Japan, and –2 to –1 per thousand in the RDCs. The UN assumes that migration will continue at approximately these levels.

Geographical differences in population sizes and growth rates are shown in Table 1. Fertility rates over the period 1950-2000 are clearly reflected in population growth rates. The RDCs have grown fastest, followed by Australia, New Zealand, and North America, followed by Japan and Europe. Over the period 2000-2050, the populations of the RDCs, Australia, New Zealand, and North America are projected to continue growing, while the populations of Japan and Europe are projected to shrink. New Zealand's projected growth rate is smaller than that of Australia and North America because New Zealand is assumed to attract less migration. Growth rates differ sufficiently over the period 1950-

2050 for the ranking of countries and regions by total population to change: North America overtakes Europe, and the RDCs overtake Japan.

Figure 4 – Estimates and projections of life expectancy, OECD countries and

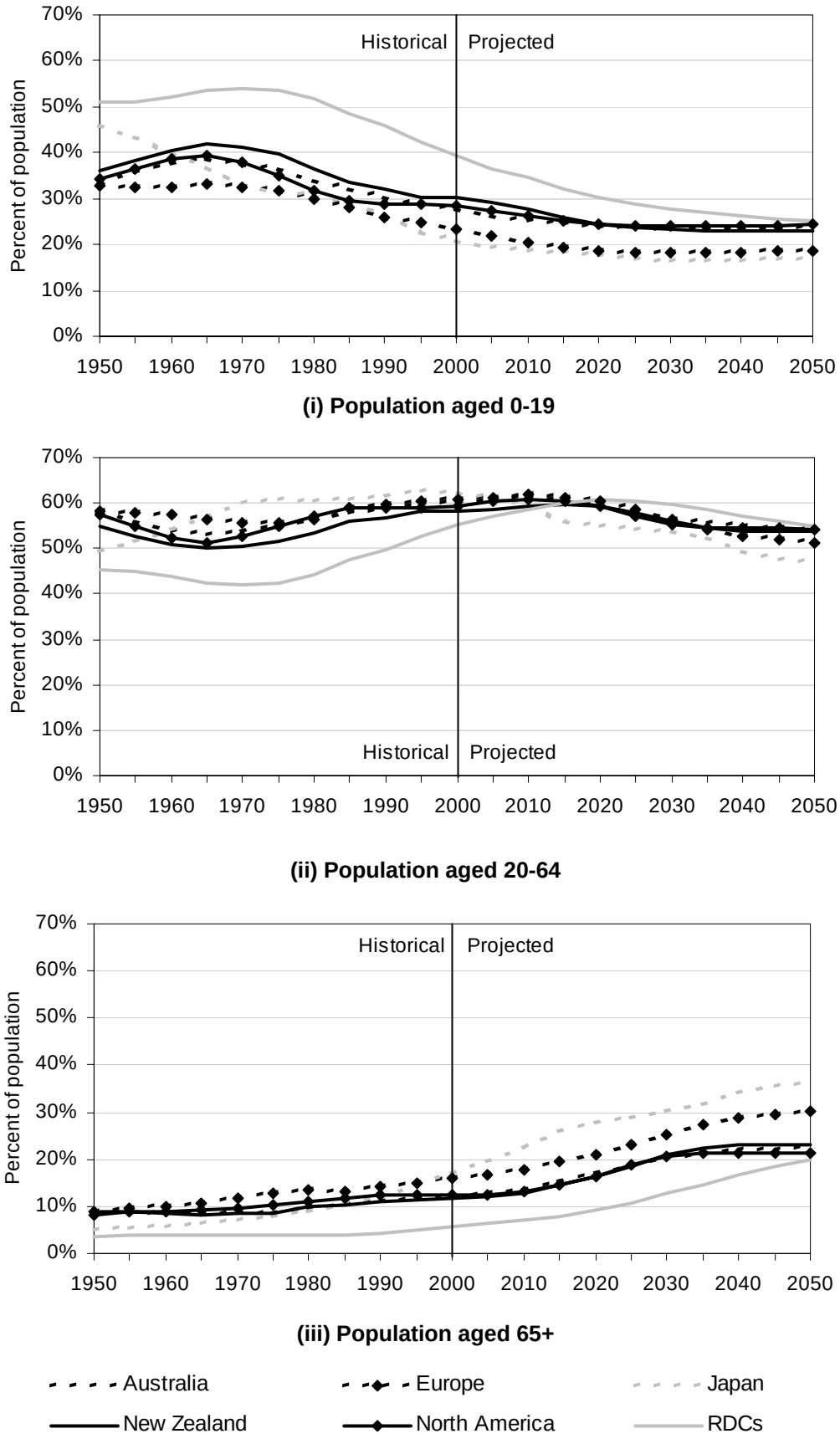


Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Geographical differences in trends in age structure are summarised Figure 5. Panel (i) indicates that the countries with the highest fertility rates have the highest proportions in the youngest age group. As Panel (iii) shows, the reverse is true for the oldest age group. Panel (ii) portrays a more complicated situation. Roughly speaking, the countries with the highest fertility initially have the lowest proportion in the working ages, until around 2010, the order reverses and these countries have the highest proportion in the working ages. This reversal occurs because a decline in fertility initially raises but then lowers the population in the working ages.

In all three panels of Figure 5, New Zealand's trajectory is very similar to that of Australia and North America. This immediately suggests that any effects that age structure *per se* has on economic growth will not greatly help nor hinder New Zealand relative to these two places.

Figure 5 – Estimates and projections for the age structure of OECD countries and regions



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

3 Effects on growth in GDP per capita

3.1 The framework

The effects of demographic trends on growth in GDP per capita can be approached using the decomposition

$$\frac{Y}{P} \equiv \frac{Y}{H}\frac{H}{W}\frac{W}{P} \tag{1}$$

where Y is GDP, P is population, H is hours worked, and W is working-age population. The decomposition implies that per capita GDP is a product of labour productivity, participation (incorporating both employment levels and hours worked), and the proportion of the population in the working ages. If a demographic trend is to affect GDP per capita, it must do so by affecting one or more of these terms.

For some purposes it is useful to look at the effect of demographic trends on growth rates rather than levels. Taking logs of Equation 1 and differentiating with respect to time yields the following equation, where r_x denotes the growth rate of x:

$$r_{\frac{Y}{P}} = r_{\frac{Y}{H}} + r_{\frac{H}{W}} + r_{\frac{W}{P}}. \tag{2}$$

The growth rate of GDP per capita is equal to the sum of the growth rates of labour productivity, participation, and the proportion in the working ages. This equation can be used to decompose historical growth rates, or to project future growth rates.

3.2 The proportion of the population in the working ages and GDP per capita

Under the decomposition set out in Equation 1, the relationship between the proportion of the population in the working ages W/P and GDP per capita is purely mechanical. If, for instance, the proportion in the working ages goes from 50% to 60%—an increase of 20%—then GDP per capita increases by 20%. An increase in the labour force might be expected to have additional indirect effects, but these must be appear as changes in the H/W and Y/H terms, and not the W/P term. Proportions in the working ages are graphed in Panel (ii) of Figure 5; the values, plus the changes in these values, are summarised in Table 2.

Table 2 -– Estimates and projections for the proportion of the population in the working ages

	Proportion of population in the working ages					Percentage increase* in the proportion in the working ages			
	Historical			Projected		Historical		Projected	
	1950	1975	2000	2025	2050	1950-1975	1975-2000	2000-2025	2025-2050
Australia	58.6%	54.7%	60.1%	57.8%	54.0%	-6.5%	9.9%	-3.9%	-6.6%
Europe	58.2%	55.7%	60.9%	58.6%	51.2%	-4.3%	9.3%	-3.8%	-12.7%
Japan	49.3%	60.6%	62.2%	54.3%	46.7%	23.0%	2.6%	-12.7%	-14.1%
New Zealand	**55.0%**	**51.6%**	**58.3%**	**57.8%**	**53.9%**	**-6.1%**	**12.9%**	**-0.9%**	**-6.7%**
RDCs	45.2%	42.3%	55.2%	60.5%	54.9%	-6.3%	30.5%	9.5%	-9.2%
North America	57.4%	54.7%	59.3%	57.1%	54.3%	-4.7%	8.3%	-3.6%	-5.0%
OECD total	55.6%	54.1%	59.5%	58.1%	52.8%	-2.8%	10.0%	-2.4%	-9.2%

*This is the percentage increase, not the percentage *point* increase. For example, the result for Australia 1950-1975 is calculated as 100%*(54.7%/58.6%-1) = -6.5%.
Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

As discussed earlier, for all countries and regions shown aside from Japan, the proportion in the working ages fell during the post-war baby boom, grew again afterwards, and will fall once more over coming decades. This is apparent in Table 2. Japan's unusual dynamics advantaged it in the past, relative to the other countries and regions shown, but have begun to seriously disadvantage it. The swings in the RDCs are in the same direction as the majority of the OECD, but are more dramatic.

In 1975, the proportion of the New Zealand population in the working ages was only 51.6%, which was 2.5 percentage points below the OECD average, and lower than any country or region shown, other than the RDCs. Since that time, however, the gap between New Zealand and the rest of the OECD has been closing; under current projections the gap will continue to close in the near future. These population movements imply an increase in the growth rate of New Zealand's per capita income, relative to the rest of the OECD. This is one case where New Zealand's demographic profile is delivering it a small advantage over Australia and North America, as well as Europe and Japan.

3.3 Growth in the working-age population and growth in labour productivity

The previous section discussed the working age population's proportional share; this section discusses its absolute size. Many economists argue that the size of the working age population can affect labour productivity, the Y/H term in Equation 1.

Changes in the size of the working age population are shown in Table 3. In all countries and regions, growth slows over time. The projected values for sizes and growth rates are quite sensitive to variations in assumptions about migration, and, over the long run, assumptions about fertility. Given these uncertainties, the most sensible way to interpret the table is probably that New Zealand, Australia, the RDCs, and North America belong to one relatively fast-growing group, while Japan and Europe belong to another relatively slow-growing group.

Table 3 – Estimates and projections for the size of the population in the working ages

	Population in the working ages (millions)					Percentage increase in the population in the working ages			
	Historical			Projected		Historical		Projected	
	1950	1975	2000	2025	2050	1950-1975	1975-2000	2000-2025	2025-2050
Australia	4.8	7.6	11.5	13.6	14.3	58%	51%	18%	5%
Europe	204.3	233.6	275.6	260.3	206.7	14%	18%	-6%	-21%
Japan	41.2	67.6	79.1	67.3	51.0	64%	17%	-15%	-24%
New Zealand	**1.0**	**1.6**	**2.2**	**2.5**	**2.4**	**52%**	**38%**	**13%**	**-4%**
RDCs	31.1	56.9	117.2	162.6	163.1	83%	106%	39%	0%
North America	98.5	133.1	186.0	219.0	237.4	35%	40%	18%	8%
OECD total	381.0	500.4	671.7	725.2	674.9	31%	34%	8%	-7%

Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Many models of endogenous economic growth and of agglomeration effects posit a positive relationship between population size or growth and labour productivity. "Population" is used implicitly to mean "working age population", so these models may shed some light on the economic implications of the trends in working age population apparent in Table 3.

Some endogenous growth models assume that labour productivity is positively related to population size or growth simply because more people means more ideas (Romer 2001). These models are sometimes cited in discussions of population ageing and countries' relative economic prospects. But it is not clear that such models are in fact relevant. After setting up one such model, for instance, Jones (1997: 21) warns that "as with many ideas-based growth models, this is a model of growth for the world economy as a whole…The Belgian economy does not grow solely or even primarily because of ideas invented by Belgians, so the model does not predict that Belgium's per capita growth rate should be related to its population growth rate.'

There are other, more plausible, mechanisms through which increased population size could raise a country's productivity. An increase in the pool of workers permits increased specialization, thicker markets, and greater potential for knowledge spillovers. Such effects may be particularly salient for small, distant economies such as New Zealand {Treasury, 2002 #3231}.

However, not all the proposed effects of growth in the working age population are necessarily favourable. Economists have long argued that if labour becomes relatively abundant, its price falls, and employers have less incentive to provide workers with capital or new labour-saving technologies. If labour becomes relatively scarce, the converse is true. A notable formal model of this process has been developed by Romer (1990). In this model, a rise in the supply of labour draws human capital from away from the production of research into the production of final goods, which lowers the rate of technical change and hence of economic growth.

There is a large literature investigating the empirical applicability of these models.[5] The remainder of this section looks briefly at some of the macro-level studies of the

[5] See, for instance, the studies reviewed by Disney (1996) and Hansen (2002).

relationship between growth in the working age population and growth in per capita productivity or incomes.

Several studies focussing directly on the relationship between growth in productivity and growth in the working age population have found the relationship to be negative. Romer (1990: 354-7) graphs movements in the working-age population and output per hour worked in the United States over the period 1839-1979 to show that, over periods of 20-40 years, increases in the growth rate of the working-age population seem to induce a one-to-one reduction in the growth rate of labour productivity. He also points out that the incomes of US applied scientists and engineers declined relative to the incomes of doctors, lawyers, and managers during the period of rapid growth in the working-age population in the 1970s and 1980s, just as his model would predict. Little and Triest (2002: 145-9) carry out a simple regression analysis on US data for the period 1904-1999, and find a similar effect from growth in the population in the working ages to growth in labour productivity and multifactor productivity. Cutler, Poterba, Sheiner, and Summers (1990: 38-45) carry out a regression with fixed country effects on data for 29 high-income countries in the period 1960-85. The relationship between growth in the working-age population and growth in labour productivity varies across specifications, but under all except one specification an increase in the growth rate of the working-age population of 1% is associated with a decrease in the growth rate of labour productivity of between 0% and 1%.

Findings such as these imply that the relationship between growth in labour productivity and growth in the working age population can be approximated by an equation of the form

$$r_{\frac{Y}{H}} = a - b r_W, \quad a,b > 0 \tag{3}$$

where a and b are constants, and b measures the extent to which growth in the working age population depresses growth in labour productivity. Substituting Equation 3 and the identity $r_{\frac{W}{P}} \equiv r_W - r_P$ into Equation 2 gives

$$r_{\frac{Y}{P}} = a + r_{\frac{H}{W}} + (1-b) r_W - r_P . \tag{4}$$

This equation implies that if the productivity-depressing effects of growth in the working age are large, then regressions of growth in per capita GDP on growth in the working age and total population should obtain coefficients for the working age population that are close to zero or negative.

This is not what happens. In their influential study of demography and economic growth in East Asia between 1965 and 1990, Bloom and Williamson (1998) regress growth rates for GDP per capita on growth rates for the working age and total population, and on other possible determinants of economic growth. Under a range of specifications, the coefficient on growth in the working age population is slightly higher than 1. This suggests that growth in the working age population did nothing to depress productivity growth. The relevance to the OECD of results from developing countries could perhaps be questioned. Brander and Dowrick (1994), however, carry out a similar analysis on data for 67 middle and high income countries over the period 1960-1985. In their preferred specification, the coefficient on growth in the working age population is also slightly higher than 1 (Brander and Dowrick 1994: Table 7).

It seems, then, that neither the empirical nor the theoretical literature provide clear guidance on how growth in the working age population affect growth in labour productivity. The significance for New Zealand's labour productivity of the trends shown in Table 3 is therefore uncertain.

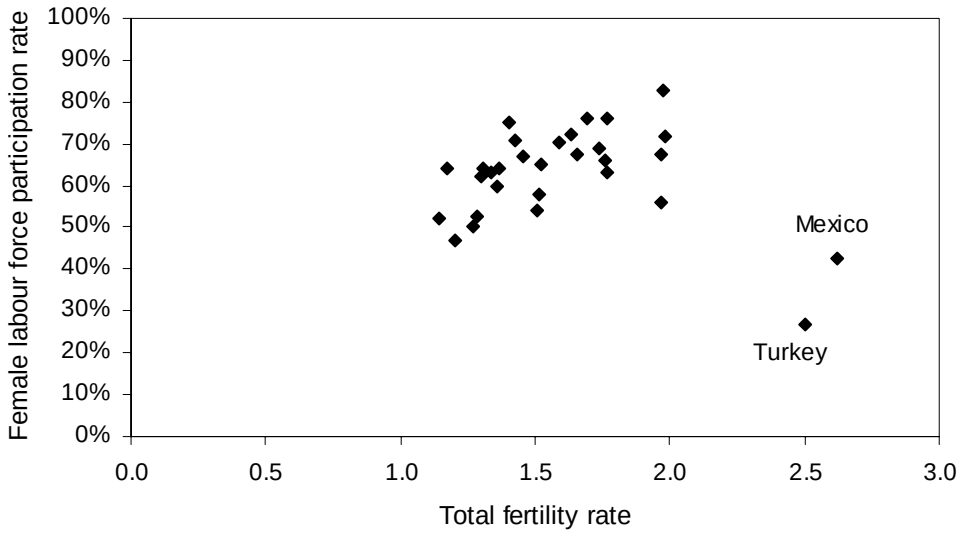
3.4 Fertility rates and female labour force participation

New Zealand and the other countries with relatively young age structures owe these age structures to relatively high fertility rates. High fertility rates might be expected to depress the participation term H/W in Equation 1, on the grounds that parenthood keeps people out of the workforce. Given the prevailing division of labour between genders, the effect on participation would presumably be most apparent for women.

Figure 6 presents 2001 OECD data on fertility rates and female labour force participation to test these ideas. The two countries with the highest fertility do indeed have the lowest participation rates. But these two counties, Turkey and Mexico, are clear outliers. Among the remaining countries, there is in fact a mildly *positive* association between fertility and labour force participation. This was not always the case: in the 1970s the association was negative (Ahn and Mira 2002). Scholars generally explain the current positive association by pointing to institutional features, such as the availability of childcare, that reduce the incompatibility of childrearing and paid work, and raise both fertility and participation (Rindfuss and Brewster 1996). The reason that Mexico and Turkey fail to conform to these generalizations is probably that they are significantly poorer than any other OECD countries, and have rather different economic and social structures.

The international literature on fertility rates and labour force participation is vast and inconclusive. Given that there is no clear relationship between fertility rates and participation, and that fertility rates have in any case been converging across the OECD (Figure 3), it seems unlikely that differences due to fertility in participation rates will be an important source of cross-country variation in per capita incomes.

Figure 6 – Female labour force participation rates versus total fertility rates, OECD 2000



Source - OECD *Health* and *Labour Force Indicators* online databases
Note - The female labour force participation rate is defined here as the female labour force as a percentage of the female population aged 15-64.

3.5 The age structure of the working age population

Within the working age population, both employment and productivity vary by age. All else equal, a change in the age structure of the working age population implies a change in average participation and productivity levels, the H/W and Y/H terms in Equation 1. Some commentators imply that these charges will be significant (OECD 1998).

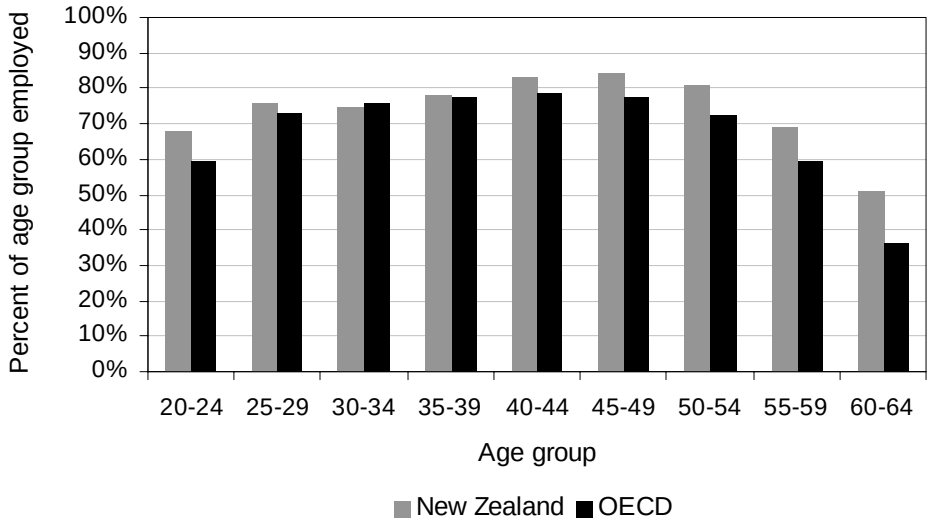
The relationship between the age structure of the working age population and average participation levels across the working-age population can be expressed with an equation of the form

$$\frac{H}{W} = \sum_i a_i \left(\frac{H}{W}\right)_i, \qquad \sum_i a_i = 1, \tag{5}$$

where $(H/W)_i$ is average hours worked by people in age group i, and a_i is the proportion of the working age population in age group i. A similar equation can be used for productivity, though in this case the a_i's measure hours worked by people in age group i as a proportion of hours worked by the whole working age population.

Figure 7 shows the proportion of age groups 20-24 to 60-64 in employment, an approximation of the $(H/W)_i$'s. Estimates are shown for New Zealand and for the OECD as a whole. Obtaining analogous estimates for productivity is more difficult, since all of the usual measures such as wages or time in employment are flawed in important ways. The standard assumption, however, is that the productivity rises and then declines with age (Stephenson and Scobie 2002: 9-10).

Figure 7 – Employment ratios by age, New Zealand and OECD, 2001



Source: Calculated from data from the OECD Labour force data online database

Note: Employment ratios are defined here as the number employed full time or part time divided by the population in the age group. All results are for males and females combined.

Are ongoing age structural changes sufficiently large to produce a significant effect on participation or productivity? Table 4 presents data on the age-structural changes. The projected age structures for 2050 are noticeably different from those of 1950: for instance, the proportion of the New Zealand working age population aged 60-64 increases from 7.5% in 1950 to 11.6% in 2050. Changes in other age groups are, however, smaller, and

the mean age of the New Zealand working age population rises by only 3.3 years over the century between 1950 and 2050.

Table 4 – Distribution of working age population by age

	New Zealand			OECD		
	1950	2000	2050	1950	2000	2050
20-24	13.3%	11.2%	10.7%	14.6%	12.1%	10.7%
25-29	13.6%	11.8%	10.1%	14.0%	12.6%	10.8%
30-34	13.0%	12.7%	9.8%	11.4%	12.7%	10.9%
35-39	13.1%	14.0%	10.4%	12.5%	12.9%	10.8%
40-44	12.1%	13.1%	11.1%	12.1%	12.2%	10.9%
45-49	10.4%	11.6%	11.6%	10.7%	11.2%	11.1%
50-54	9.1%	10.7%	12.1%	9.6%	10.4%	11.6%
55-59	7.9%	8.3%	12.6%	8.1%	8.5%	11.9%
60-64	7.5%*	6.7%	11.6%	7.0%	7.5%	11.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mean age (years)	40.0	40.7	43.3	39.8	40.7	42.9

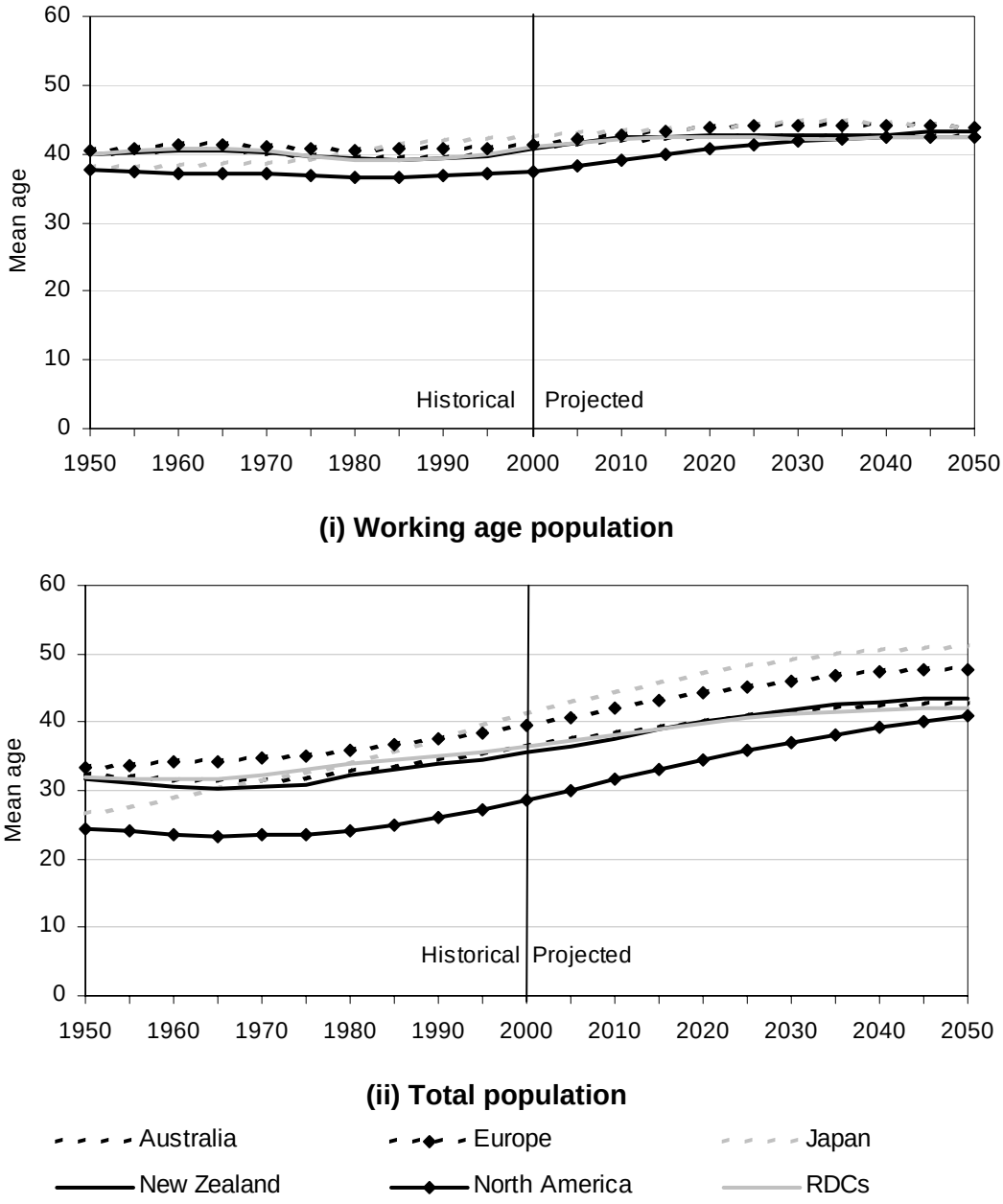
Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.
*The high figure for 1950 is not a typological error. It probably reflects the effects of the fertility decline from the late 19th Century to the early 20th Century, which mean that older cohorts in 1950 were unsually large, compared with younger cohorts.

As Figure 8 shows, changes in the mean age of the working age population are relatively small across the OECD, and much smaller than changes in the mean age of the entire population. Similarly, cross-country differences in the mean age are far smaller for the working age population than for the total population. The reason is that most variation across time and between countries in the overall age structure of the population is due to variation at the youngest and oldest ages.

The expression for the mean age of the working age population is $\sum_i a_i m_i$ where m_i is the mean age of people in age group i.[6] This has exactly the same form as Equation 5, the equation for average participation, with the m_i's replacing the H/W's. The fact that the age structural changes do not have much effect on the mean age therefore suggests that they would not have much effect on the participation rate either. This is indeed the case. If, for instance, the OECD age specific employment ratios shown in Figure 7 are applied to the age structure of the New Zealand population in 1950, the overall ratio is 69.2%. If the same age specific ratios are applied to the age structure in 2050, the overall ratio is 67.2%. The peak occurs in 2000, when the overall ratio reaches 69.9%. The changes are small. Performing the same calculations for other countries yields similar results. In the absence of good estimates of age-specific productivity rates, no such calculations are possible for productivity. But because the relationship between overall rates, age-specific rates, and age structure is essentially the same, there is no reason to believe that the effect of changing age structures on productivity would be any more striking.

[6] The calculations in Table 4 and Figure 8 use the values 22.5, 27.5, 32.5, and so on. Strictly speaking, using the midpoints assumes that the population is distributed evenly within each age group. This assumption is not met in practice, but this does not materially affect the results.

Figure 8 – Estimates and projection of the mean age of the working age and total population, OECD countries and regions



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

The overall conclusion is that the effects of changes in the age structure of the working age population on participation and productivity are likely to be small. There is therefore little scope for trends in the age of the working age population to advantage or disadvantage New Zealand relative to other OECD countries.

3.6 Young dependants and old dependants

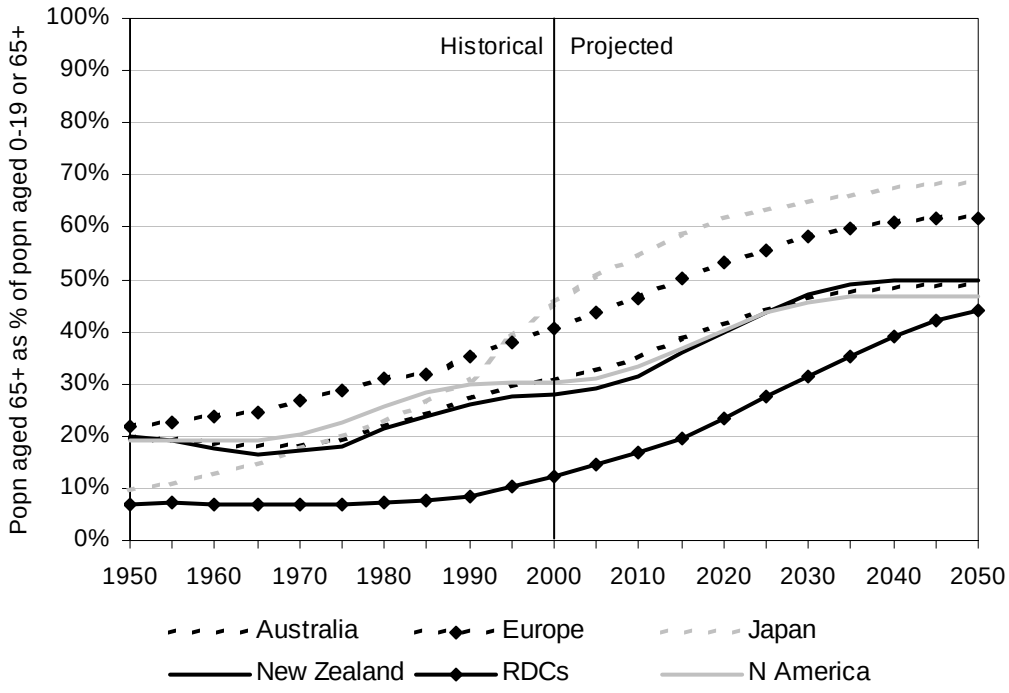
The complements of measures of the population in the working ages are measures of the dependent population. The most frequently-cited such measure is the "dependency ratio", generally defined as the ratio of the population outside the working ages to the population inside the working ages. A fall in the proportion inside the working ages implies a rise in the dependency ratio. As can be seen in Panel (ii) of Figure 5, the proportion in the

working ages is projected to begin falling in New Zealand, and in all the other selected countries and regions, some time within the next 20 or 30 years. However, the projected declines are not large, and would only return most countries and regions to the levels of the 1970s.

As Panels (i) and (iii) of Figure 5 show, the reason the dependency ratio is relatively stable is that increases in old-age dependency are offset by decreases in youth dependency. This implies that the balance between young dependants and old dependants is shifting towards old dependants. Figure 9, showing old dependants as a percentage of total dependants, bears this out. In contrast to the changes in the share of dependants in the total population, the changes in the share of old dependants in total dependants are large. In 1950, young dependants predominated throughout the OECD, but by 2050 old dependants are projected to make up 60%-70% of all dependants in Europe and Japan and around 50% elsewhere, including New Zealand. If, as many demographers believe, the UN has underestimated the scope for future mortality declines, the share of old dependants will be even higher than Figure 9 suggests.

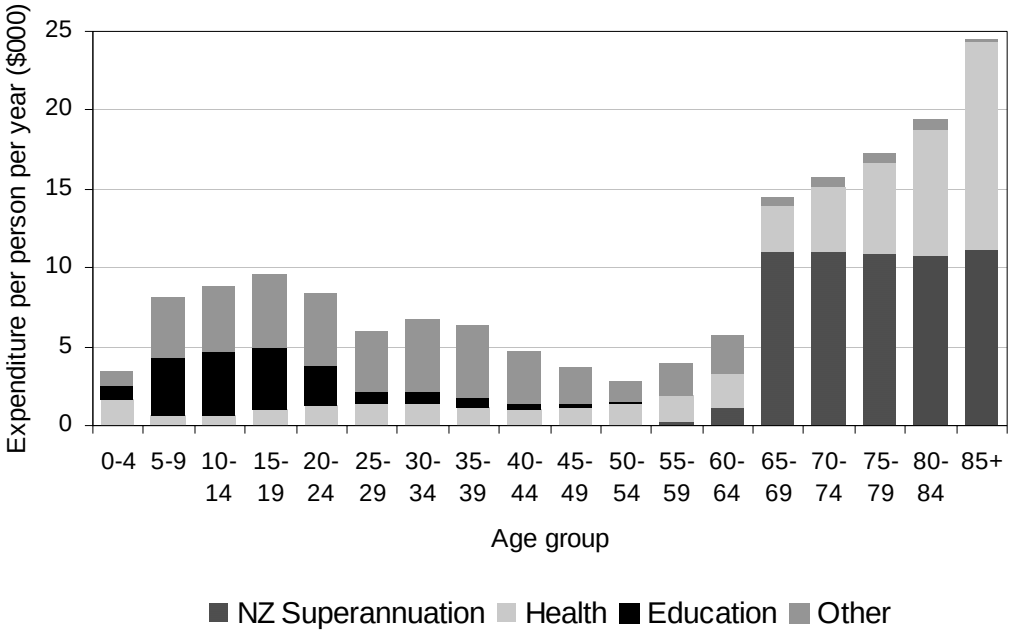
Under current patterns of expenditure, the shift to old-age dependency is probably increasing the amount of resources transferred to dependants by the state. Across the OECD, government social expenditures per old person are much larger than expenditures per young person (Weil 1997: Table 10). Illustrative data for New Zealand are shown in Figure 10. Expenditures increase sharply between ages 60-64 and 65-69 as people become eligible for New Zealand Superannuation, and climb steadily after that, reflecting health care costs. As the share of the population in these high cost age groups increases, overall social expenditures can be expected to rise.

Figure 9 – Estimates and projections for the population aged 65+ as a percentage of population aged 0-19 or 65+, OECD countries and regions



Source: Calculated from data from the UN Population Division's *World Population Prospects* online database.

Figure 10 – Government social expenditure per person per year, New Zealand 2001



Sources - All data apart from health expenditure data were obtained from Creedy and Scobie (2002: Appendix Tables 4,5). Health expenditure data were obtained from the New Zealand Treasury's Long-Term Fiscal Model (www.treasury.govt.nz/ltfm/default.asp). Combined male and female totals were obtained by weighting by population numbers from the 2001 Census, available at from the Statistics New Zealand website www.stats.govt.nz.

A recent paper by Razin, Sadka, and Swagel (2002) challenges this conclusion. Razin *et al* construct a political-economic model in which, under certain parameter settings, an increase in the old-age dependency leads a majority of voters to support a decrease in social expenditures per capita. Razin *et al* carry out a panel regression using data for 13 OECD countries, and obtain results suggesting that rising dependency is indeed associated with falling social expenditures per capita. Razin *et al*'s regression does not, however, distinguish between changes in overall dependency due to rises in old age dependency and changes due to falls in youth dependency. When Razin *et al*'s regressions are adjusted to allow for this distinction, rising old age dependency is found to be associated with rising, not falling, social expenditure per capita (Bryant 2003b). The standard assumption that increases in old-age dependency imply increases in fiscal pressures appears to be vindicated.

Governments of countries where a shift towards old-age dependency is creating pressure for increased social expenditures face unpalatable choices: holding expenditure down regardless, cutting other areas of government expenditure, raising taxes, building up debt, or doing some combination of the above. There is, of course, extensive debate among economists about the extent to which these various measures reduce welfare or reduce participation and productivity. For instance, some critics of the World Bank (1994) report *Averting the Old Age Crisis* argue that the Bank exaggerates the harm done by higher tax rates (Beattie and McGillivray 1995). The Bank has, however, stood its ground (James 1996). Indeed, it is hard to believe that increased taxes would not have some effect on participation or investment decisions, and that increased public expenditure on pensions and health care would not partly crowd out productivity-enhancing public expenditure on infrastructure, schools, and research. To the extent that fiscal pressures do threaten participation and productivity, the somewhat lower old-age dependency rates in New

Zealand, Australia, the RDCs, and North America are likely to give them a slight economic advantage over Europe and Japan.

4 Conclusion

UN estimates and projections for the OECD over the period 1950-2050 show population growth slowing, the proportion of the population in the younger age groups declining, the proportion in the older age groups rising, and intermediate age groups left relatively unchanged. For most purposes, the countries and regions considered in this paper fall into two groups, with New Zealand, Australia, the recently developed countries, and North America in one "high fertility" group, and Europe and Japan in a "low fertility" group. The slowing of population growth, reduction in the share of the young, and increase in the share of the old are more marked in the low fertility group than in the high fertility group.

Summaries of the paper's conclusions about specific demographic trends and the effect of these trends on New Zealand's GDP per capita, relative to the rest of the OECD, are given in Table 5. As the table shows, neither New Zealand's comparatively high fertility, nor its relatively young working age population, are likely to have much influence on New Zealand's relative economic performance. The fact that the proportion of the population in the working ages will decline less quickly in New Zealand than elsewhere in the OECD (other than the recently developed countries of Korea, Mexico, and Turkey) will be to New Zealand's relative advantage, though the effect is unlikely to be large. There is much greater uncertainty about the effects of growth in the absolute size of the working age population, and the effect of differences in the balance between old and young dependants. The former may either help or hinder the high fertility countries such as New Zealand, while the latter will almost certainly be of some help, though how much is unclear. The combined effect of the demographic trends is likely to be positive, though the magnitude is uncertain.

Table 5 – Summary of specific demographic trends and their effect on the growth in GDP per capita in New Zealand relative to other OECD countries and regions

Demographic trend	Effect on relative GDP per capita
Proportion of population in the working ages projected to decline less in NZ than elsewhere in the OECD, except for the RDCs.	Slight advantage over rest of OECD, other than RDCs, via "population" term *W*/*P*. Magnitude of effect moderate but predictable.
Working age population projected to continue increasing over next 20-30 years in New Zealand, Australia, North America, and RDCs, and to decline in Japan and Europe.	Potentially conflicting influences on productivity (*Y*/*H*). Positive influences through agglomeration effects, and negative influences through reduced returns to investment in capital and labour-saving technologies. Net effect extremely uncertain.
Fertility levels higher in New Zealand, Australia, North America and RDCs than in Europe and Japan.	Little evidence for common assumption that higher fertility implies lower participation (*H*/*W*). Effect likely to be small.
Working age population younger in New Zealand, Australia, North America and RDCs than in Europe and Japan.	Changes in the age structure of the working age population smaller than generally thought, and have only a minor influence on average participation (*H*/*W*) and productivity (*Y*/*H*). Effect small and predictable.
Old-age dependency low and youth dependency high in New Zealand, Australia, North America and RDCs, compared to Europe and Japan.	Fewer fiscal pressures, and hence less likelihood of tax rises or expenditures cuts threatening participation (*H*/*W*) and productivity (*Y*/*H*). Effect positive, but highly uncertain.

Assessing the importance of demographic change to growth in GDP per capita currently involves a large element of subjective judgement. It is reasonable, however, to hope that future progress in the economics of population will reduce some of the uncertainties. Of the potential areas for future research indicated in Table 5, the effects of growth in the working age population perhaps deserves the greatest attention. The size of the working age population is one variable over which governments can exert substantial control, through migration policy. But at present, the research literature gives no clear answers on whether the net effect on GDP per capita of continued labour force growth is positive or negative.

Despite all the uncertainties, however, there is an important sense in which judgements about the importance of demographic change can be less tentative than judgements about other influences on future economic performance. Demographic trends are one of the few social trends for which predictions 20 or 30 years into the future are not just speculative. It is reasonable to expect that demographic trends will help New Zealand gain some economic ground on Europe and Japan, though perhaps not Australia and North America. This serves as a reminder that, for all the disadvantages it is believed to face, New Zealand's economy also enjoys a few advantages.

Recognition of New Zealand's relatively favourable demographic conditions is important when assessing the relevance of imported advice for dealing with the "old age crisis", particularly if this advice originates from Europe or Japan. The differences between New Zealand's demographic conditions and those of Europe and Japan are differences of degree rather than kind. But population issues that deserve urgent attention in Europe and Japan do not necessarily deserve the same attention here. Setting appropriate priorities depends, among other things, on a proper understanding of ongoing demographic change.

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